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U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

Docket No:	70-143
Licensee No:	SNM-124
Report No:	70-143/2004-206
Licensee:	Nuclear Fuel Services, Inc.
Location:	Erwin, TN
Inspection Dates:	November 1 - 5, 2004
Inspectors:	Larry Berg, Criticality Safety Inspector Dennis Morey, Senior Criticality Safety Inspector
Approved by:	Melanie A. Galloway, Chief Technical Support Group Division of Fuel Cycle Safety and Safeguards, NMSS

[redacted]

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Enclosure

EXECUTIVE SUMMARY

Nuclear Fuel Services, Inc.
NRC Inspection Report No. 70-143/2004-206

Introduction

Staff of the U.S. Nuclear Regulatory Commission (NRC) performed a routine and announced nuclear criticality safety (NCS) inspection of the Nuclear Fuel Services, Inc. (NFS), Erwin, Tennessee, facility from November 1 through 5, 2004. The inspection included an on-site review of the licensee programs dealing with plant operations, the criticality alarm system, the NCS function, NCS Audits, and NCS-related corrective actions. The licensee programs were acceptably directed toward the protection of public health and safety and in compliance with NRC regulatory requirements. The inspection focused on risk-significant [redacted] material processing activities including [redacted] and related process areas, the Blended Low Enriched Uranium (BLEU) preparation facility, the [redacted] warehouse, and the Waste Water Treatment Facility.

Results

- One violation was identified related to implementation of the licensee's nuclear criticality safety program.
- Plant operations involving [redacted] materials were otherwise conducted safely and in accordance with written procedures.
- The NCS function was adequate for maintaining acceptable levels of safety.
- The licensee NCS audits were adequate for maintaining acceptable levels of safety.
- The licensee demonstrated adequate coverage of the [redacted] Warehouse by the criticality alarm system and will have full documentation available upon completion of criticality alarm system coverage calculation upgrades.
- An unresolved item was identified associated with the licensee's investigation of the aborted transfer of highly enriched uranium solution from favorable geometry to unfavorable geometry, and identification of long-term corrective actions to prevent recurrence.
- A non-cited violation was identified associated with the discovery of an unattended temporary fixture in the BPF.

REPORT DETAILS

1.0 Plant Operations (88015)

a. Scope

The inspectors performed plant walkdowns to review activities in progress and to determine whether risk-significant [redacted] material operations were being conducted safely and in accordance with regulatory requirements. The inspectors verified the adequacy of management measures for assuring the continued availability, reliability and capability of safety-significant controls relied upon by the licensee for controlling criticality risks to acceptable levels. The inspectors performed walkdowns of risk-significant [redacted] material processing activities including [redacted] and related process areas, the BLEU preparation facility (BPF), the [redacted] warehouse, and the Waste Water Treatment Facility. The inspectors interviewed operators and NCS engineers both before and during walkdowns.

The inspectors reviewed selected aspects of the following documents prior to performing the walkdowns:

- 54X-04-0034, "Nuclear Criticality Safety Evaluation [redacted] Facility," Revision 2, dated October 7, 2004
- 54X-04-0023, "Nuclear Criticality Safety Evaluation [redacted] Facility," Revision 0, dated August 18, 2004
- 54X-04-0012, "Nuclear Criticality Safety Evaluation [redacted] Facility," Revision 1, dated August 16, 2004
- 54X-04-0041, "Nuclear Criticality Safety Analysis [redacted] Facility," Revision 3, dated October 21, 2004
- 54T-04-0119, "Nuclear Criticality Safety Evaluation for Waste Water Treatment Facility," Revision 0, dated October 7, 2004
- 55T-04-0033, "General Cleaning [redacted]," Revision 1, dated May 18, 2004
- 54X-04-0040, "NCSE for [redacted] Facility," Revision 1, dated October 10, 2004
- 54X-00-0042, "NCSE [redacted] Facility," Revision 3, dated September 9, 2004
- 54X-04-001, "NCSE [redacted] Facility," Revision 3, dated August 25, 2004
- NFS-HS-CL-19-01, "Nuclear Criticality Safety [redacted] Warehouses," Revision 3, dated October 25, 2004

b. Observations and Findings

The inspectors verified that the controls identified in the NCS analyses were installed or implemented and were adequate to assure safety. The cognizant NCS engineers were knowledgeable and had good interfaces with operators on the process floors.

During a tour of the BPF, the inspectors identified two examples where grossly contaminated and visibly damp absorbent material were not being stored in accordance with licensee procedure 55T-04-0033. The inspectors noted that the as-found absorbent material was stored in potentially unfavorable geometry plastic bags having potential volumes greater than [redacted]. The inspectors observed that the plastic bags had been used to seal the bag-out ports[redacted].

Safety Condition No. S-1 of Special Nuclear Material License No. 124 requires that material be used in accordance with the statements, representations, and conditions in the license application dated July 24, 1996, and supplements thereto. Section 2.7 of the license application requires operations and safety function activities to be conducted in accordance with written procedures. Steps 7.2.1(5) and 7.2.2(5) of licensee procedure 55T-04-0033 requires the placement of absorbent material into [redacted]. Contrary to the above, on and before November 2, 2004, the licensee failed to comply with the [redacted] material handling requirements of 55T-04-0033. Specifically, the licensee did not store contaminated absorbent material [redacted]. The failure to comply with the [redacted] material handling requirements of 55T-04-0033 is an example of **Violation (VIO) 70-143/2004-206-01.**

During a walkdown of the [redacted]Warehouse, the inspectors noted a criticality safety posting near the receiving desk that was different than the others in the building. A licensee criticality safety engineer noted that the posting was a previous version that did not arise from a criticality safety analysis. The licensee immediately removed the outdated posting. Section 2.7 of the license application requires operations and safety function activities to be conducted in accordance with written procedures. Step 1.0 of licensee procedure NFS-HS-CL-19-01, "Nuclear Criticality Safety [redacted] Warehouses," Revision 3, dated October 25, 2004, states, in part, "This supplement documents the currently approved Station Limits Cards for the [redacted] Warehouses. The Station Limit Cards are to be posted on or near each location and it must be in accordance with this document." Contrary to the above, on or before November 2, 2004, the licensee had a criticality safety posting displayed in the [redacted] Warehouse which was not at an approved location and was not in accordance with the procedure. Specifically, the licensee had an outdated posting displayed at the [redacted] Warehouse receiving desk. The failure to comply with the Station Limits Card requirements of NFS-HS-CL-19-01 is another example of **Violation (VIO) 70-143/2004-206-01.**

c. Conclusions

One violation was identified related to implementation of the licensee's nuclear criticality safety program. Plant operations involving fissile materials were otherwise conducted safely and in accordance with written procedures.

2.0 NCS Function (88015)

a. Scope of Inspection

The inspectors reviewed NCS evaluations to determine that criticality safety of risk-significant operations was assured through engineered features and human performance (controls) with adequate safety margin/certainty, preparation and review by capable staff. The inspectors reviewed selected aspects of the following documents:

- 54X-04-0034, "Nuclear Criticality Safety Evaluation [redacted] Facility," Revision 2, dated October 7, 2004
- 54X-04-0023, "Nuclear Criticality Safety Evaluation [redacted] Facility," Revision 0, dated August 18, 2004
- 54X-04-0012, "Nuclear Criticality Safety Evaluation [redacted] Facility," Revision 1, dated August 16, 2004
- 54X-04-0041, "Nuclear Criticality Safety Analysis [redacted] Facility," Revision 3, dated October 21, 2004
- 54T-04-0119, "Nuclear Criticality Safety Evaluation for Waste Water Treatment Facility," Revision 0, dated October 7, 2004
- 54T-04-0122,"Nuclear Criticality Safety Evaluation [redacted]," Revision 5, dated October 6, 2004
- NFS-HS-A-58, "Nuclear Criticality Safety Evaluations," Revision 7, dated November 6, 2001

b. Observations and Findings

The inspectors determined that analyses were performed by capable NCS engineers, that independent reviews were completed for the evaluations by other qualified NCS engineers, that subcriticality of the systems and operations was assured through appropriate limits on controlled parameters, and that double contingency was assured for each credible accident sequence leading to inadvertent criticality. The inspectors determined that NCS controls for equipment and processes assured the safety of the operations.

The inspectors observed that changes to the Waste Water Treatment Facility NCS evaluation had recently been implemented with an incomplete technical basis. The inspectors observed that the revised Waste Water Treatment Facility NCS evaluation did not technically justify the adequacy of a new subcritical concentration limit which had been developed to replace existing mass controls. Through interviews with the NCS technical reviewer responsible for the Waste Water Treatment Facility, and tours of the facility which had begun operating to the new concentration limit, the inspectors determined that the subcritical concentration limit was set at a value orders of magnitude greater than the concentrations associated with normal operations, and that multiple independent failures of items relied on for safety would be necessary for the

subcritical concentration limit to be exceeded. The inspectors determined that the subcritical concentration limit assured the safety of the operation.

Safety Condition No. S-1 of Special Nuclear Material License No. 124 requires that material be used in accordance with the statements, representations, and conditions in the license application dated July 24, 1996, and supplements thereto. Section 2.7 of the license application requires operations and safety function activities to be conducted in accordance with written procedures. Step 5.2(a) of licensee procedure NFS-HS-A-58 requires the technical reviewer to ensure completeness and accuracy of the bases for the evaluation, the results of the evaluation, documentation of the evaluation, and application of the evaluation. Contrary to the above, on and before November 2, 2004, the licensee failed to ensure the completeness and accuracy of the basis for NCS evaluation 54T-04-0119. The licensee's failure to ensure the completeness and accuracy of the basis for NCS evaluation 54T-04-0119 is a violation of minor risk-significance and will not be subject to further enforcement action.

During the inspection, the licensee agreed to develop additional guidance for technical reviews to ensure that reference documents that justify the technical bases of subcritical limits are accurate and complete before operational implementation. The licensee's development of additional guidance to ensure accurate and complete technical reviews will be tracked as **Inspection Follow-up Item (IFI) 70-143/2004-206-02**.

c. Conclusions

The NCS function was adequate for maintaining acceptable levels of safety.

3.0 NCS Inspections, Audits and Investigations (88015)

a. Scope

The inspectors reviewed previously completed audits of [redacted] operations. The inspectors reviewed selected aspects of the following documents:

- 21T-00-0540, "Nuclear Criticality Safety Audit Writer's Guide," Rev. 0, dated July 6, 2000
- 21T-01-0669, "Safety Audits and Inspections," Rev. 6, dated July 6, 2001

b. Observations and Findings

The inspectors observed that the NCS audits were conducted in accordance with the requirements specified in the NCS audit writer's guide, and procedure 21T-01-0669. The inspectors noted that the NCS engineers: (1) reviewed open NCS issues from previous audits; (2) reviewed the adequacy of control implementation; (3) reviewed plant operations for compliance with license, procedures, and postings; and (4) examined equipment and operations to determine that past evaluations remain adequate.

The inspectors determined that licensee NCS audits were adequate for maintaining acceptable levels of safety.

c. Conclusions

The licensee NCS audits were adequate for maintaining acceptable levels of safety.

4.0 Criticality Accident Alarm System (88015)

a. Scope

The inspectors reviewed the status of criticality alarm system upgrades and reviewed criticality alarm system detector placement calculations for the [redacted] Warehouse.

b. Observations and Findings

During a tour of the [redacted] Warehouse, the inspectors observed [redacted] material storage bins [redacted]. The bins were in use for storage of [redacted] material. Licensee staff indicated that the bins had been in the warehouse for approximately 20 years, had originally been used for the storage of [redacted] material in shipping configuration and were not required for currently stored material. Licensee staff also indicated that the criticality alarm coverage calculation for the [redacted] Warehouse was one of the oldest calculations and did not consider the presence of the high density bin walls. During the inspection, licensee staff demonstrated coverage of the warehouse by performing a point depletion calculation. The inspectors agreed that the result given by the licensee calculation adequately demonstrated that the minimum accident of concern would not be shielded from the criticality alarm system detectors by the high density concrete bin walls.

Based on the inspectors' original concern that the calculations for the [redacted] Warehouse were dated, licensee staff indicated that the 15 criticality coverage calculations were being updated with 11 already completed. The remaining four calculations are expected to be completed next year. Upgrading of criticality alarm system coverage calculations will be tracked as **IFI 70-143/2004-206-03**.

c. Conclusions

The licensee demonstrated adequate coverage of the [redacted] Warehouse by the criticality alarm system and will have full documentation available upon completion of criticality alarm system coverage calculation upgrades.

5.0 NCS Event Review

a. Inspection Scope

The inspectors reviewed the licensee response to a recent NCS reportable event. The inspectors reviewed the progress of investigations and interviewed licensee staff regarding immediate and long-term corrective actions. The inspectors reviewed selected aspects of the following documents:

- 55T-50-0163, "Letter of Authorization No.: LOA-1877I-008," dated October 22, 2004.
- 21T-04-0713, "Nuclear Criticality Safety for the BLEU Preparation Facility," Revision 2, dated June 23, 2004

b. Observations and Findings

On October 26, 2004, the licensee initiated a transfer of low concentration highly enriched uranium solution from the favorable geometry caustic discard tanks associated with the [redacted] process to an unfavorable geometry receiving tank. The licensee determined that the transfer was initiated based on samples from a previously transferred solution batch. The licensee reported that the transfer was terminated by activation of an active engineered control, initiated a full team TapRoot investigation, and a facility safety-stand-down. Immediate corrective actions taken by the licensee included sampling and laboratory analysis of the solution held up in the discharge line, non-destructive analysis scans of the receiving tank and transfer lines.

The licensee's investigation into the cause of the aborted transfer was not completed by the end of the inspection. The licensee's investigation of the aborted transfer, and identification of long-term corrective actions to prevent recurrence will be tracked as **Unresolved Item (URI) 70-143/2004-206-04**.

The licensee NCS procedure for the BPF requires NCS approval of temporary fixtures used in the facility. The licensee issued an LOA to allow the transfer of solution [redacted] to facilitate inventory. The inspectors were concerned that the LOA did not specifically control the fixture, a flexible hose, used for the procedure by specifying diameter, length, or connector information. The licensee agreed that this was an important aspect of actually controlling temporary fixtures. Section 2.7 of the license application requires operations and safety function activities to be conducted in accordance with written procedures. The LOA, in Section 3.3, specified that the hose must be attended at all times when removed from the approved storage location. Contrary to the above, the licensee reported that on October 25, 2004, the hose was found connected to the system and unattended after the operation was completed. The licensee immediately removed the hose. The licensee viewed the event as an isolated procedure violation of a non-NCS requirement. The inspectors noted that the risk significance of the procedure violation was low due to the shape and length of the hose

and the expected [redacted] material content of the transferred solution. This non-repetitive, licensee identified and corrected violation is being treated as a non-cited violation consistent with Section VI.A.8 of the NRC Enforcement Policy.

c. Conclusions

In the area of NCS reported events, an unresolved item was identified associated with the licensee's investigation of the aborted transfer of highly enriched uranium solution from favorable geometry to unfavorable geometry, and identification of long-term corrective actions to prevent recurrence. A non-cited violation was identified associated with the discovery of an unattended temporary fixture in the BPF.

6.0 Open Items

IFI 70-143/2004-204-02

This item tracked implementation of final corrective actions to assure criticality alarm audibility in a suspect area. The suspect area was a booth in the [redacted] Warehouse in which the criticality alarm was not audible when the heater/air conditioner was operating. The licensee resolved the concern by installing a 15 Watt criticality alarm horn in the area. The inspectors reviewed the horn installation and audibility test results and concluded that the issue was resolved. This item is closed.

IFI 70-143/2004-201-02

This item tracks resolution of criticality accident alarm system equipment and installation problems. The inspectors determined that funds to conclude the criticality alarm system upgrade project have been allocated and that the project will include a central, continuously monitored alarm station. The inspectors also determined that the incidence of trouble alarms has declined due to correction of installation problems. This item remains open.

7.0 Exit Meetings

The inspectors presented the inspection scope and results to members of the licensee's management and staff during an exit meeting on November 5, 2004, and a telephone re-exit was held on December 6, 2004, with the licensee's nuclear criticality manager. The licensee acknowledged and understood the findings as presented.

SUPPLEMENTAL INFORMATION

1.0 List of Items Opened, Closed, and Discussed

Opened

VIO 70-143/2004-206-01	Failure to comply with the [redacted] material handling requirements of 55T-04-0033 and the Station Limits Card requirements of NFS-HS-CL-19-01
IFI 70-143/2004-206-02	Tracks development of additional guidance to ensure accurate and complete technical reviews
IFI 70-143/2004-206-03	Tracks upgrading of criticality alarm system coverage calculations
URI 70-143/2004-206-04	Tracks licensee's investigation of the aborted transfer and identification of long-term corrective actions to prevent recurrence

Closed

IFI 70-143/2004-204-02	Tracks implementation of final corrective actions to assure criticality alarm audibility in a suspect area.

Discussed

IFI 70-143/2004-201-02	Tracks resolution of criticality accident alarm system equipment and installation problems.

2.0 Inspection Procedures Used

IP 88015	Headquarters Nuclear Criticality Safety Program

3.0 Partial List of Persons Contacted

Nuclear Fuel Services, Inc.

*R. Mauer	Engineer, NCS
*A. Maxin	Director, Safety
*B. Moore	Vice President, Safety and Regulatory
**R. Shackelford	Manager, NCS
M. Tester	Manager, Radiological Control
*A. Vaughan	Director, Fuel Production
*J. Kirk	Licensing Specialist
*B. Fore	Manager, Fuel Production
*J. Nagy	Licensing and Regulatory Compliance
R. Ratnor	Health Physicist, Nuclear Measurements
*C. Miller	Engineer, NCS
*N. Newman	Vice President, General Counsel

NRC

*D. Rich	Senior Resident Inspector, NFS
*D. Morey	Senior Criticality Safety Inspector, HQ
**L. Berg	Criticality Safety Inspector, HQ

* Denotes attendance at the exit meeting on November 5, 2004.
**Denotes attendance at the re-exit meeting on December 6, 2004.